# Circle Organic Farm Building & Root Cellar

Endeavour Centre SNC 2013 Project

# About this book

The Endeavour Centre's Sustainable New Construction program undertakes the design and construction of an innovative sustainable building project each year.
The participants in the program work with Endeavour faculty to construct the project and participate in all elements of the building.
In 2013, the SNC group worked on the farm building for Circle Organic farm in Millbrook, Ontario.

# Circle Organics

The 2013 project for Endeavour's Sustainable New Construction program saw us engaging in an exciting design and build aimed at helping local organic food security.

Circle Organic Farm was looking to scale up their production to enable them to provide organic produce year round. This strategy included a processing facility for their vegetables, accommodation for their workers and a large, buried root cellar for food storage. A greenhouse was not in our scope of work, but also part of the overall project.

The processing building includes a large vegetable washing area, a small retail outlet for on-farm sales, and space to do specialized production. Upstairs, the building provides a kitchen for value-added activities and three bedrooms for farm workers, as well as washroom, a meeting room for farm meetings and an office space.

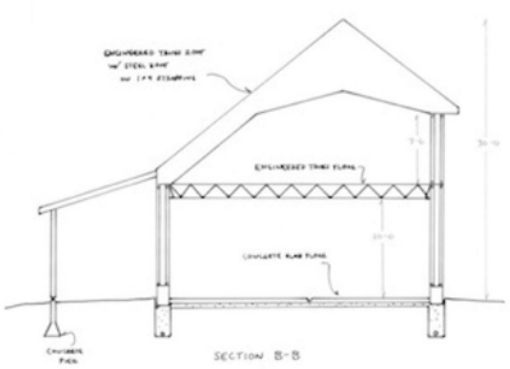
Attached to the processing building is a subterranean root cellar. In order to keep both buildings on the same level, it was decided to construct the root cellar at the existing grade and then bury it. This is intended to give the root cellar a good base temperature provided by the ambient ground temperature, allowing ideal storage conditions to be achieved with a minimum of energy inputs.

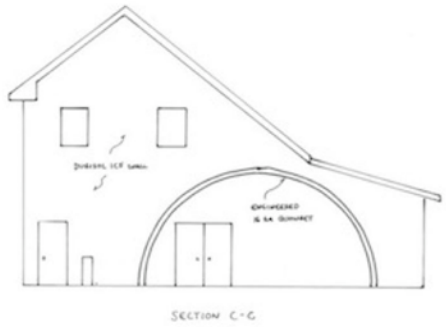
We were able to use a very innovative foundation system for this project, using locally produced expanded glass beads to create a structural and insulated foundation system in a single process.

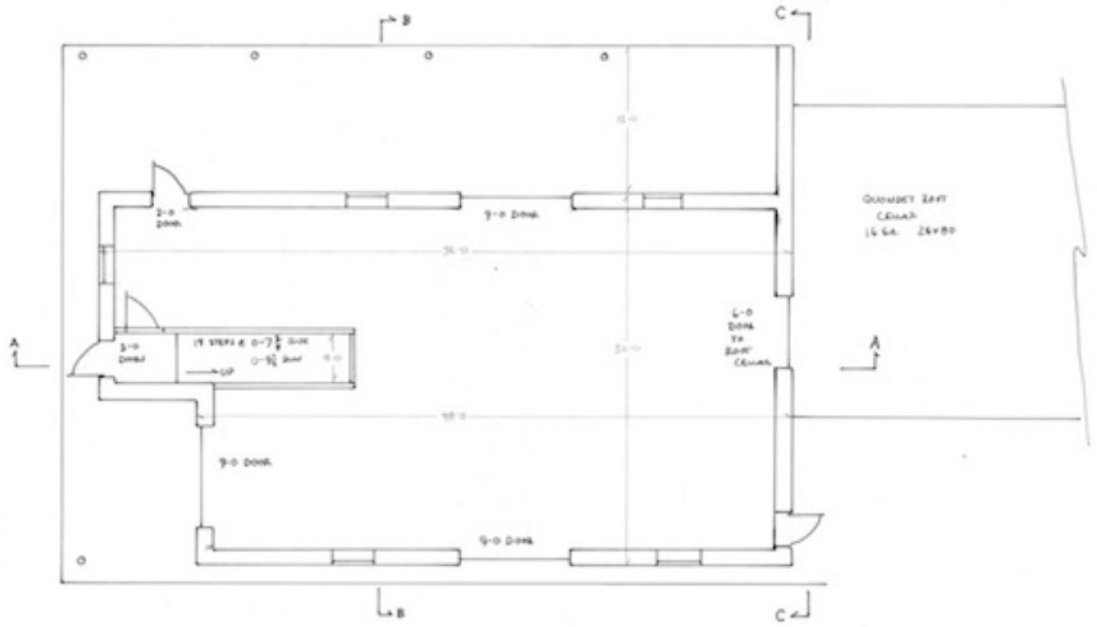
In every way, this project meets Endeavour's goals of providing leading sustainable building ideas and materials for the benefit of the wider community.



The class of 2013 pose during a tour of the Camp Kawartha Environment Centre (built by the class of 2009). Representing five different countries of origin, it was a fun and diverse group!




The section drawing shows the quonset hut root cellar sharing the same grade with the processing facility. The main floor plan shows the open washing/processing area.


Despite some late season snow, the digging of the rubble trench foundation gets underway.
Earth tube ventilation pipes and drainage tiles are laid in the bottom of the trench

Used carpet lines the dig for the trench, providing a barrier between the soil and the rubble and some insulation value. Roxul drainboard (right) can serve the same purposes.

A larger crushed stone (4 inch) was used in the rubble trench. This proved very difficult to move by hand/shovel, so a loader was used to fill the trench.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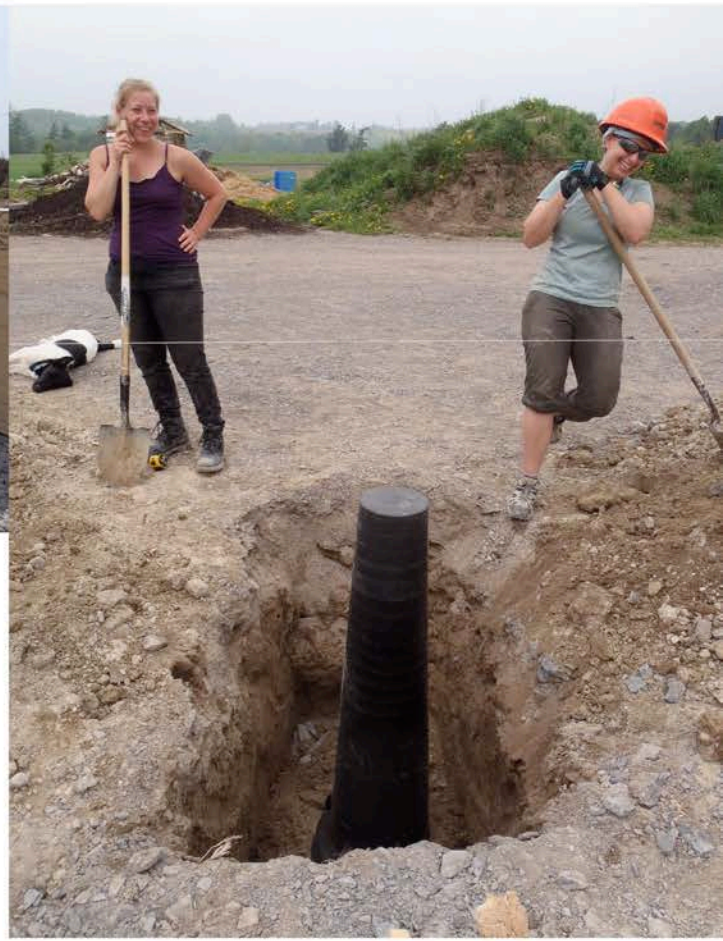
The 4 inch rubble is compacted into the trench until it reaches existing grade. A layer of 3/4 inch stone is then compacted over the entire foundation area of the building.



Formwork is constructed on the gravel pad for the Poraver foundation. Pier tubes are dug to support the timber frame on the north side of the building.

High slag content concrete is poured into the pier tubes and into the foundation forms, creating a 4 inch thick footing to support the Poraver foundation.




Poraver is an expanded glass bead project made from recycled glass. Very lightweight yet strong, the beads are cast with a binder made from hydrated lime and metakaolin, which is a byproduct of the glass bead manufacturing process.

Wire mesh is bent into a “cage” to provide tensile strength inside the Poraver stem wall. Bart oversees the mixing process, while Gord demonstrates appropriate safety gear for the job.

The Poraver mix is emptied from the mortar mixer into wheelbarrows and is brought to the forms, where it is dumped and spread inside the forms.

The Poraver mix is quite dry and requires manual tamping to ensure an even density without air pockets. Lara provides her body weight to flatten the top surface.

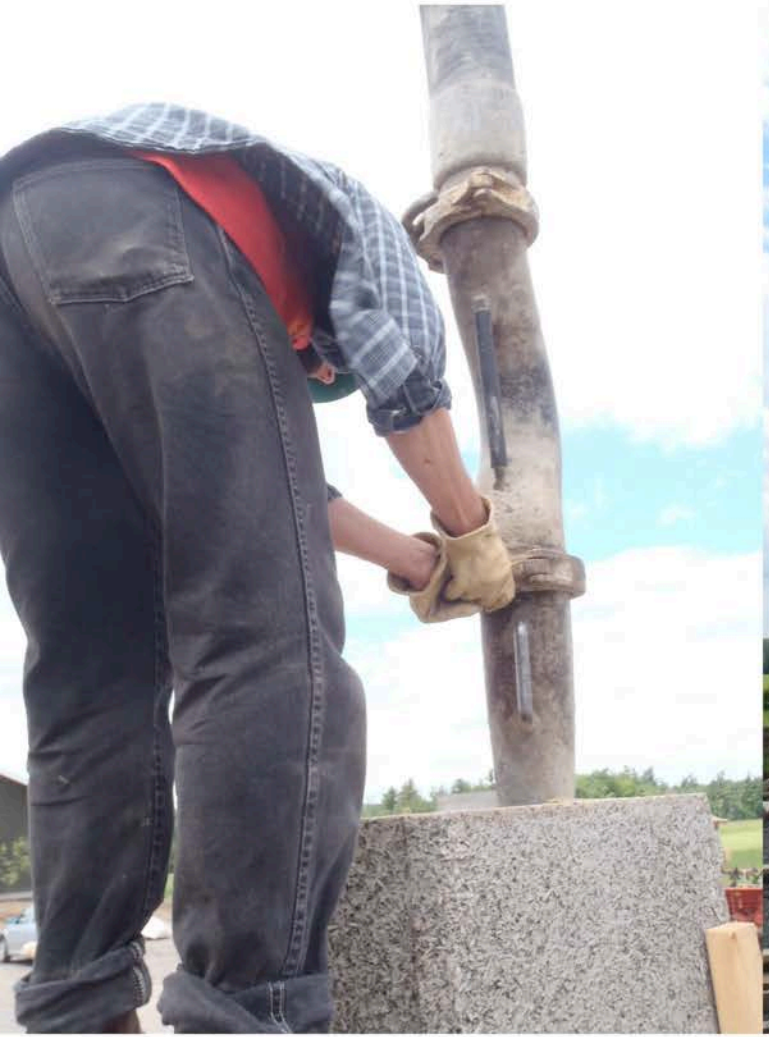


The formwork is stripped from the foundation wall after 24 hours. The hydraulic reaction of the lime/metakaolin mixture ensures that it is set. Kevin paints slip on the edges to help bind them and protect from damage.

Wall framing begins in earnest, the sections having been built during the foundation forming process. The 2x4 double frames go up quickly.

With the framing nearly completed for the first story, the formwork for the quonset hut root cellar footing is completed.

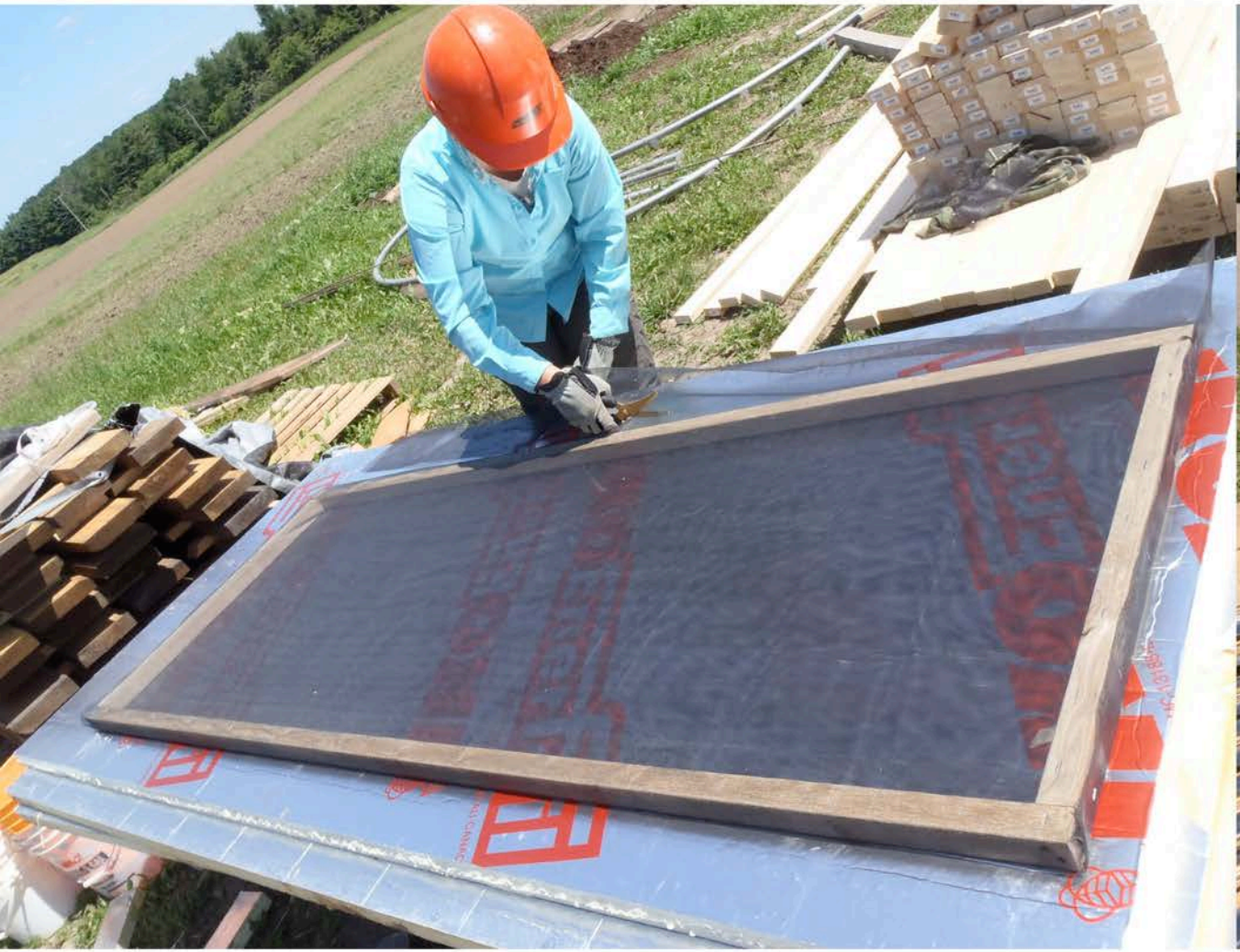
Durisol blocks begin to form the dividing wall between the processing building and the root cellar. The blocks are dry stacked and the cores poured with high slag concrete.

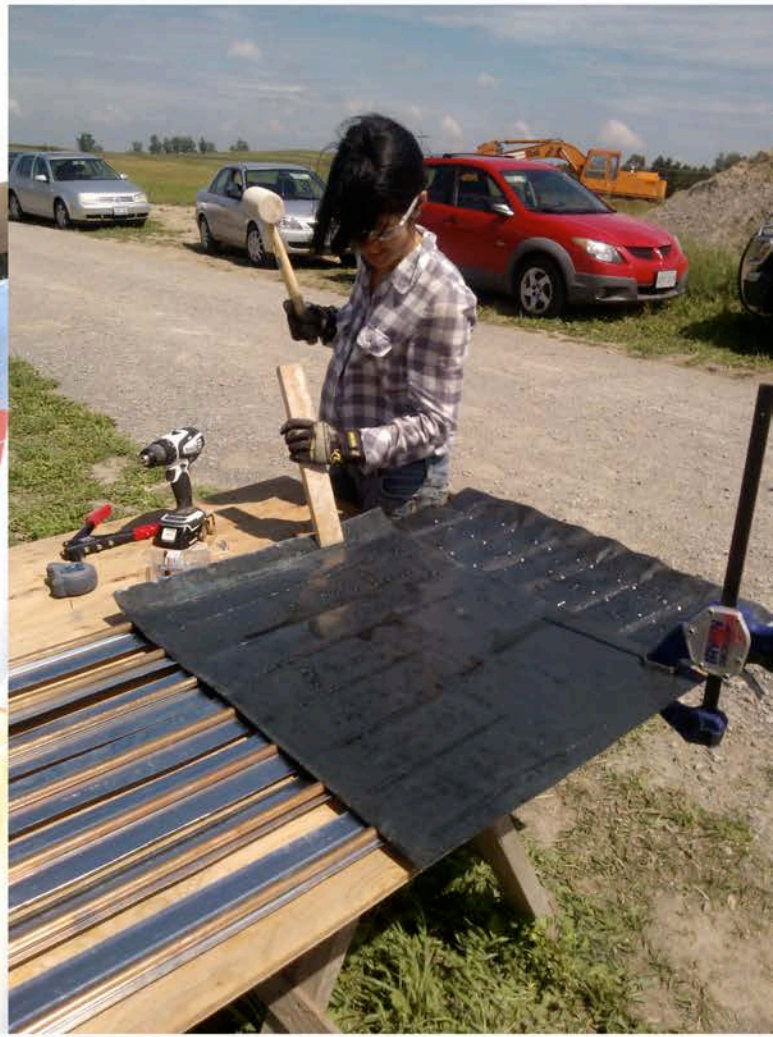


A concrete pumper truck is used to core fill the Durisol blocks. In very short order, the first floor height of the Durisol wall is completed.

The timber frame for the north porch is cut and fit in the shelter next to the building. Instructor Mark Davidson provided the basics, and the class completed the frame.

Home made solar hot water and hot air collectors are built from used panels. Kara prepares the double screen innards of the air units and Melissa solders up pipes for the water units.





Two layers of screen force air to move through the mesh and get warmed on the air collectors. Copper pipe has used copper sheet form fitted to increase water collector area.



Second floor framing begins with open web joists and a plywood deck. Second floor walls are framed and raised on this platform.


The roof trusses arrive and are placed on the second floor deck. The crew frames them up and braces them. The open south face and the protected northern exposure are now formed.

The roof shape defines the building, and the steel roof offers protection for construction phases to follow.

A heavy 10 mil poly vapour barrier is placed on the floor area and caulked to the Poraver foundation. A high slag concrete slab is poured on the main floor.

The north side timber frame is assembled on the pier foundation. Rough cut hemlock rafters are cut to rest on the hemlock frame.


BP deckgard

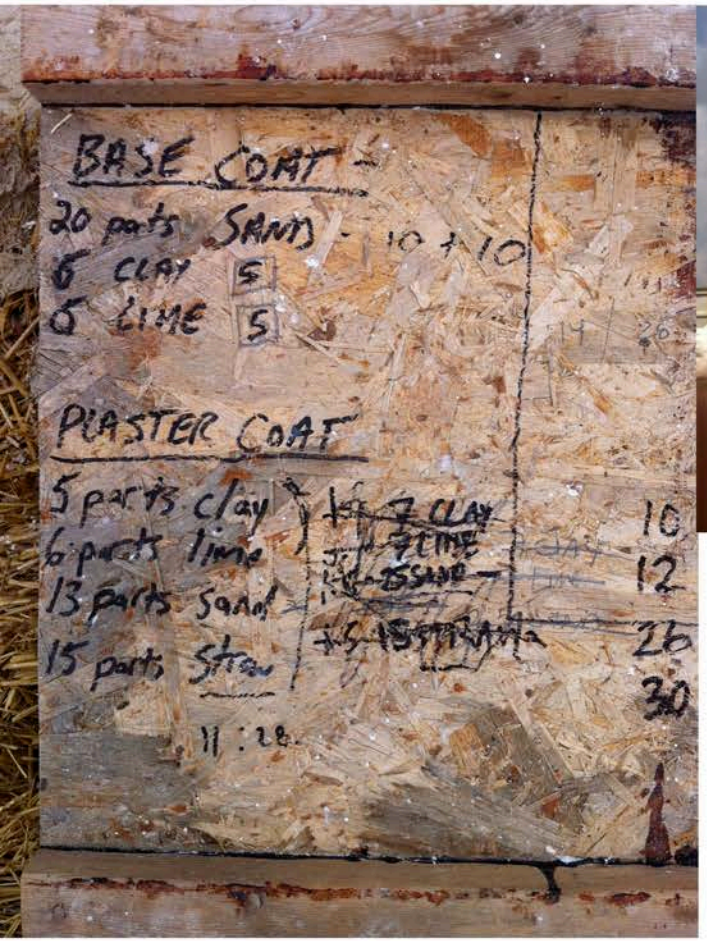


The straw bales arrive and the space between the two stud frames is insulated with loose Poraver in preparation. The bales are inserted in stud cavities that are one bale in length.

The bale raising goes quite quickly in the evenly spaced stud cavities.

Melissa handles custom bale sizing with an electric chainsaw while the rest of the crew fill up each wall with bales.

The walls are prepared for plastering, which includes flashing and meshing around windows and over the metal base flashing that covers the Poraver foundation.





A new type of plaster is made from the same ingredients as the foundation binder. It uses hydrated lime and metakaolin with a very high percentage of chopped straw.


The plastering process involves preparing the surface with a no-straw mix, into which the high-straw mixed is pressed by hand. Floats are used to smooth surface. One thick coat is all that is required.

The interior of the bale walls have trim and window sills made from live edge lumber acquired from a local sawmill.


"Lifetime" is a mineral protectant used on the wood siding on the upper floor of the building. The board and batten siding is fastened to angled strapping to provide bracing and ventilation behind the siding.

The quonset hut that will form the root cellar begins to be installed. Each prefab metal arch is assembled on the ground and then lifted into place.

The quonset hut sections are bolted together to form the 80 foot length of the root cellar.



The class of 2013 poses in front of their handiwork. A few participants were able to stay on to help with completion work of the building.


NovaWrap
NovaWrap
NovaWrap
NovaWrap



The main building is nearly complete. The quonset hut receives a double layer of wooden strapping to support the concrete cloth covering that strengthens and waterproofs the cellar.

The concrete cloth is laid over the strapping and then sprayed down with water to activate the hydraulic setting of the concrete embedded in the canvas.

A rounded “parapet” is created to hold back the soil that will be placed on the quonset hut. It too is covered with concrete cloth.

Soil is backfilled against the quonset hut. Ventilation tubes are placed to provide air supply to the storage areas. Each lift of backfill is compacted. Keeping loads balanced is important!



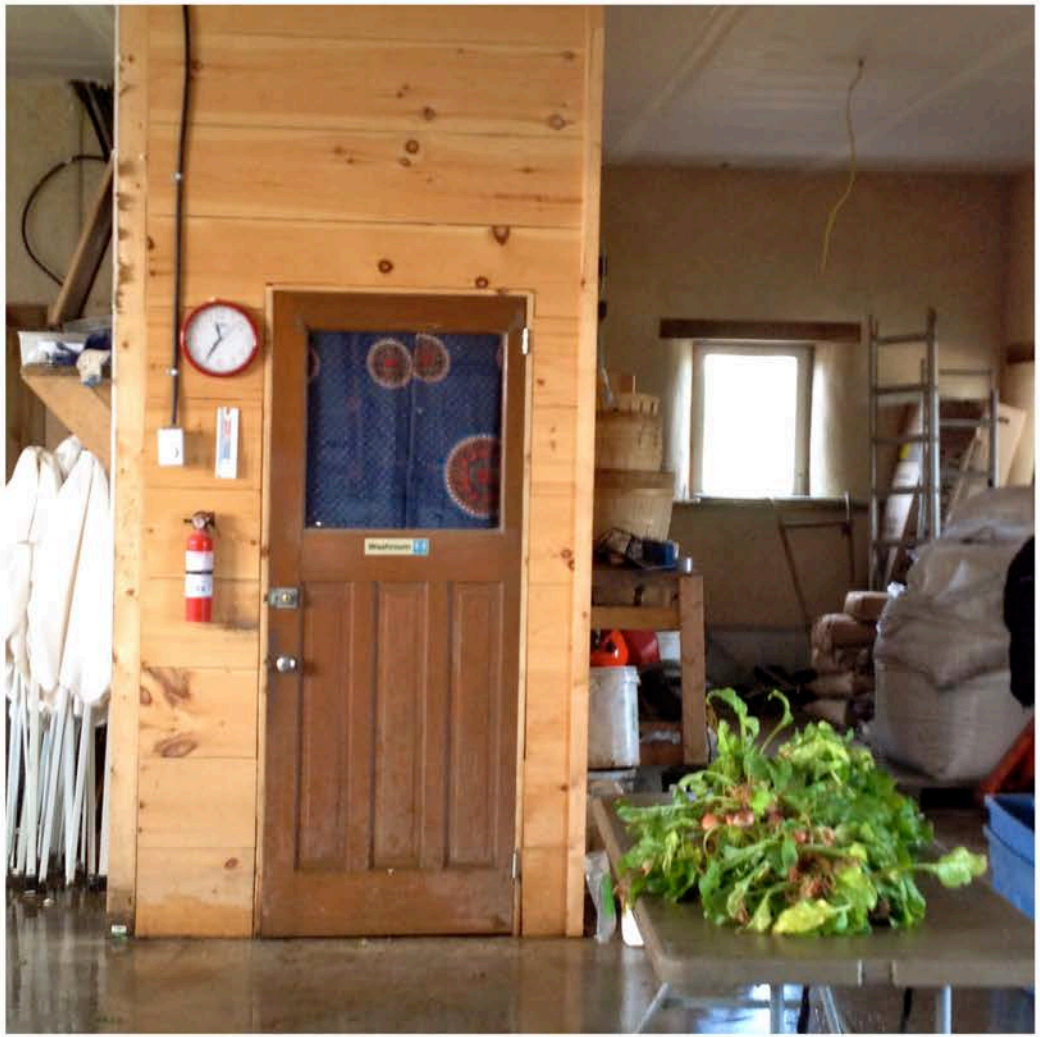
Soil begins to bury the root cellar.

Veggies start to fill the root cellar even before it's finished. Upstairs, the kitchen and meeting area are brought to completion, ready for farm workers to inhabit.

Snow arrives early, and just in time for the exterior of the building to be finished and the root cellar to be buried!

Looking from atop the buried root cellar, one can survey much of the farm property.


The large covered porch welcomes farm visitors who pick up their vegetables, and provides lots of sheltered storage.





The inside of the building shows the “organized chaos” of a busy working farm.

# Circle Organics

Endeavour would like to express thanks to the class of 2013 for their dedication and effort on the Circle Organic Farm project:

Bart Glumineau
Kara Holzmiller
Noah Earle
Flawio Soares
Clayton Linton
Amber McCrae
Melissa Furukawa
Lara Tarroni
Gord Magill
Kevin Karl

We couldn't have asked for a better crew!